Notebook Series -- Notebooks by Edison
Notebook, N-18-07-11

This notebook is a continuation of N-18-07-02. It was used by Edison in July 1918 in connection with his work for the U.S. Navy during World War I. Many of these notes were made in or near the garage at Glenmont, Edison's home in Llewellyn Park, New Jersey, where he was working with John A. Hanley, William A. Hayes, Sherwood T. (Sam) Moore, and other employees on a series of experiments pertaining to the measurement and detection of sound under water. Included are tests with various devices used to pick up and amplify the sound of dripping water, possibly as a way of compensating for the interference experienced in listening to a sound detection device as it was towed behind a moving vessel. Other tests involve simulated submarine sounds. Among the components employed are brass and rubber tubes, telephone receivers, microphones, reverberators, and audions. Some experiments involve sounds transmitted from within a large iron annealing pot procured from the Edison Storage Battery works. The experiments are continued in N-18-07-18.2. The cover is marked "No 2." The pages are unnumbered. Approximately 120 pages have been used.

July 11 1918

Continued from Book 1

We rest phone & tube on Table & hold water end in hand
Hayes gets 30 –

We put in 1/2" 1/32 wall tubing phone on sponges water end plugged & resting right on small table. –
Hayes gets Nothing –

Phone on table no sponges
Hayes gets 30 ..

We now put phone on sponges, the water end we put on diaphrm no hole plate used + support pipe on sponges

Hayes gets over 60

We now move phone 4 ft away should be over 4 times weaker

Hayes gets 56

We now move stands so phone is 78 inches -

Hayes gets 56.

Must be some Vib transmitted

We now put 2 sponges at both ends one on top of the other

Hayes gets 56
Hurley 56

Square distance dont work
Something wrong —
We now remove diaphram
+ plug hole in Tube.
Hayes gets Nothing

We recorded on phonograph white wax the sound due to a drop of water falling 6' ft

Used a very sensitive recorder 2 1/2/1000 Ohm - Water dropping on rig board across bbl + using 6" mouth 2 1/2 ft funnel, Could not get any signs of a record — funnel within 1/2" of Edge of board —

Edison Could not hear a sound when listening in funnel but heard the thud when pencil resting of board + held in teeth

the Boys say they hear drop loud all over

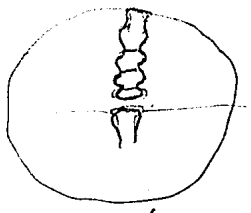
room & even in listening room with both doors shut

Finally we used a 2" dia 15/1000 Mica & let the water drop drop dually on the dia.

Phonograph - 100 Rev min - Circumference of 1 Rev on max 6.75"

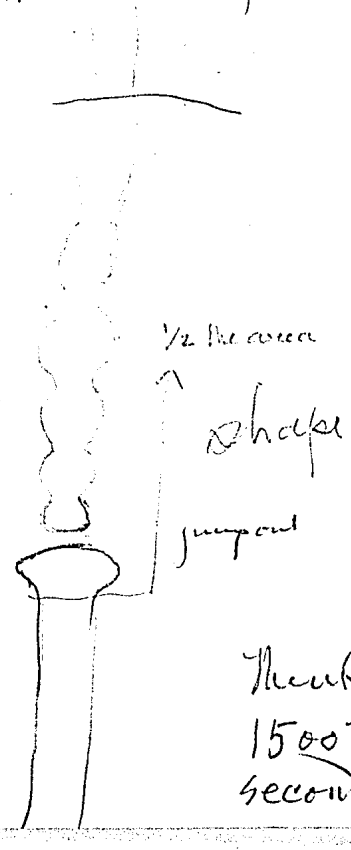
Dia of objective of micro area 1/10th of inch -

The bunch of rapid waves due to one drop reach 1/2 way across the area. about 7



Short waves, each one longer than the other.

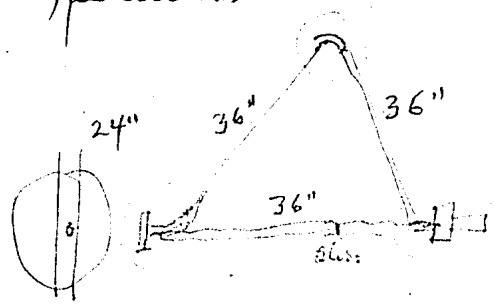
finally after the pronunciation
short vowels cease to be pronounced
a lot of short very needs ~~[illegible]~~
longer vowels can just be seen
if phone recorded on tape
but not many if phone held
in hand



think about
1500 to 1650 per
second

Expt 2 July 12 1918

We now resume compensating Experiments



Tripod supports – lead on sponges – 1½/100 Mica dia – no hole plate – drop falls 6 ft

Plugged hole in receiver.

Hayes gets 46

Harley 46

We shut all windows & doors leading to testing room 46 ?

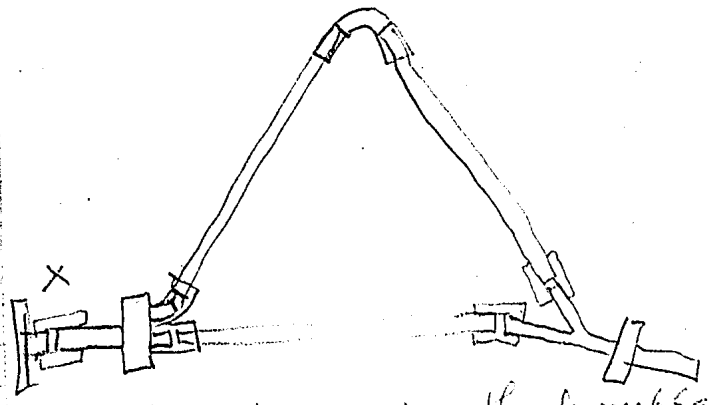
Under Exactly same conditions of dropping — 6 round over 66 & 6' ft drop. They now say they hear it in Listening room thru air walls or floor vertical audion —

Of course they always have heard it thru Even when they separated from audion Nothing — Disconnection of mechanism & brain accounts for this —

We now try stethoscope tubes to see if we can shut out jarr of drop — getting to ear —

Have just found that thin rubber tube joint in △ acts as diaphram

WE



allow ~~[illegible]~~ use thick rubber for connections, tubes nearly butt, 3/8 @ 1/4"

Hear to 28 – This has improved it, We now solder phone at X to Brass Outlet + test. 28 ~~on~~ Box

WE put sponges under the board that water drops on get 28 on box

Without audion, listening in
Listening room doors & windows
Shut board on sponges
where water drops can't
hear anything

but without sponges can't
hear with disconnected phones
connected to ear, but listening
in room can just hear
as there is some noise outside
probably it would be strong
in Delaware.

We now do away with rubber
joints & solder the triangle
tubes together making

the path twice as far one way as the other, -

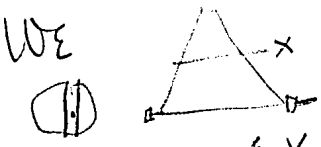
Hayes 43
Hanly 44

Water direct on 66°

Day it rings like a metal now. has lost the dull thud it had before —

We put water board on sponges at 66°.

Hayes 44
Hanly 44

We  put a wrench across pipes at X

44
44

We put 1st tripod legs (holding the microphone receiver) on blocks wood on springs –

Hayes 38
Hardy 40

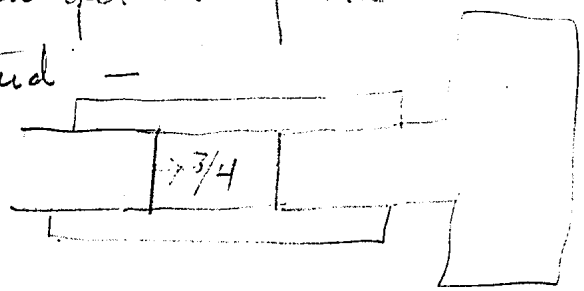
With Valve at X

We cut off all column at X.

Hayes 38 –
Hardy 40 –

Its a musical sound due to sound waves striking metal

We now saw off Bell phone & put on a rubber tube joint, to see if we can get rid of the Bell like thud —



This may act as diaphram - but it may change the sound of music character.

Hayes 32 — its still musical
Hanley 32

Note

later, it may not be the lead

How small a air leak into a closed system will produce such loud results both in circuit & direct by stethoscope,
all joints should be covered by Rubber or tape

We now cover the pipes with one layer of black tape put on Diagonally

Hayes
Hardy

NOTHING

The slot where we adjust tube one inside the other was covered with tape in above Experiment where we got nothing. When we took off tape to expose joint got for 2"

32 on box — after retaping got Nothing

The great trouble we all have
Experiments is that say 1 o'clock
you get 40 on both at
2 o'clock nothing at 3 o'clock
40, Solely due to outside
noises affecting the hearing
The only way is to use a
sound proof booth.

We now take tape off of
all the tubes & only tape
the leaky joint.

Hayes
Hanley Get Nothing

We now take tape off joint
& are just where we
started ie bare tubes all
soldered except one rubber
tube joint at Magneto Phone

Hayes
Hanley Nothing —

This is rotten before under same
conditions got 45 —

Cant find where it came from probably at adjusting Valve or Mullers Valve at water end —

In any event we can get rid of it —

We took cork out of plugged end at Water phone + got water 60 on box ditto when Muller Valve turned so only straight pipe got water but we didnt punch off the ^ other Bellphone

end –

We are going to lower
drop to 2 ft to weaken
second Gacon 60 on 60x

Hayes 50 Valve shutting
Hanley 52 off

We lower pile so it
drops 1 ft only

Hayes
Hanley Can't recov

We put it up to 18 inches
(12) the drop distance
Hayes 40
Hanley 40

We now close valve so triangle complete to see if it lowers round,

Hayes 20. only when dead quiet
Hanley only get at intervals

~~We disconnect the triangle at Hanley valve and valve~~

We now use a single separate tube

Hayes 48

Hanley 46 –

We now put back triangle

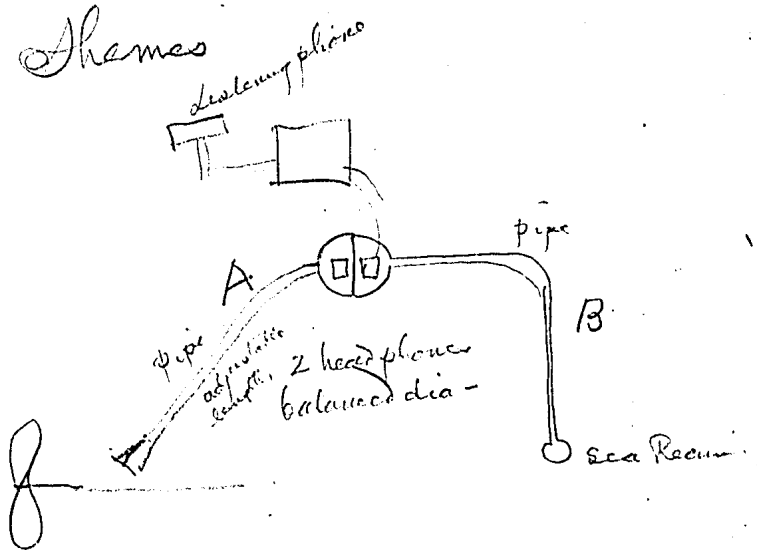
Hayes, 24

Hanley 24

Very hard to get accurate movements close at times

This seems to work

Themes



Boat screw noise read up B
ditto duplicate up A -
+ A adjusted to reach
dia at same instant, are
balanced out but any
noises at a distance like
a sub or torpedo the
is out of balance on
balancing phone next page

We now make a triangle
Each side being 1 ft - all
soldered with true pipe at
Each end to fasten phones on
rubber tube -
being used to attach true
phone -

We plug water end of phone
and see what we get

Hayes Nothing
Hanley

We now take plug out

Hayes 50
Hanley 50

No

The bug in this is waves received from water phone & from shaft mounted boat are as to component waves probably unlike & therefore will not balance of their shapes & sequence were the same it would be ok but its very doubtful

The practical short circuiting of listening phone at the exact moment they reach listening phone seems only practical method over next page

As Cargo boats give 1 Red
Seconds
+ slowest speed of sub 4 knots
give 2.3 per sec + over
6 when observing position
for firing—
There is a great difference
the Cargo boat gives out
the second only 1/8 of total
time, 87½ of time of
chase is due to heavy
submarine,

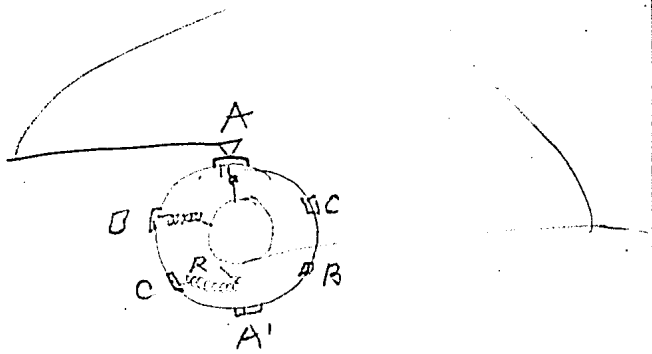
Here is a scheme = suppose
we had a rotating device
giving say from 120 to 350
dots of sound per min
imitating Morse given by a sub

If this was adjusted to a certain rate its power regulated so it couldnt be heard amid the general noise, supposing the sub was in vicinity of that couldnt be heard amid general noise,
If now the artificial bell was increased in speed it would at some point equally commade with the data of sound given by submarine & the two added could be heard,

See next page

should use not use Audion
a central wheel on
shaft could be provided with
a circular battery whereby
at the listening stethoscope
The tubes could be pounded
down by a magnet at
the exact time the sound of
our own voice would be
heard & thus eliminate it
and adjusted so it would
do it almost exact laq rate
Possibly a shutter could
be used with slit so at
moment when sound
should be heard the
shutter closes off sound
& it must be quick at
least could use
Parsons grid valve

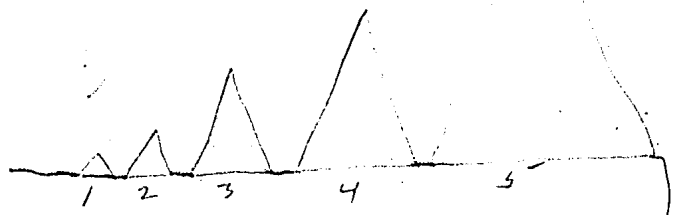
For shortcircuiting on shaft provided this



A A' has very little Res
B B' More Res
C C" still more corresponding to their different strength of sound

These Resistances rotate with the shaft & all are connected to ring

Scheme to make an intermittent sound
Continuous



a group of leaders each 1 ft long
but 6 leaders in group makes
group 6 ft long
No 1 triangle is 6X12
hence the group on exit well 6E
12 ft long - allen Exit from No 2
24 ft long No 3 48 ft long
No 4 96 ft long No 4 well 6E
192 ft long + funnel Exit from
No 5, 384 ft long
by used 7 triangles it would
be 1000 ft or more a 6E continuous
next page

by the lagging effect of the triangle, the angle tubes being made slightly longer to compensate for twice the length. The volume or strength of lagging waves would be same as in straight pipe.

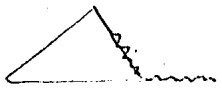
If propeller sound of 6 interruptions from a Revolution got to Ear from our own boat there would be plenty. The gaps of silence could be filled in by taking sound from another boat & passing them through a series of incrementally lengthened triangles ~~with~~ & passing them into the ear tube leading to the Ear then making waves from boat revolution sound

Conclusion.

Triangle neutralization scheme not very promising because sounds are not periodic & also occurs in patches not one of the vibrations of which is periodic or sample amplitude.

by using triangles - the short section of which is long enough to hold all the waves of a patch the strength can be reduced 50% as the volume is halved in splitting & one section passes out of short tube just as the other section joins the tail of

The other



reduce 1/2 the triangle & twice as long
by using an additional triangle
the short side twice as long
the Vacuum is weakened to 1/4
& so on the sound of sentinels
with increasing triangles
would become extinction

We drop this line of
Experiment for the time being
& go on compensating
for propeller sounds by
short field balancing
plan

July 14 1918

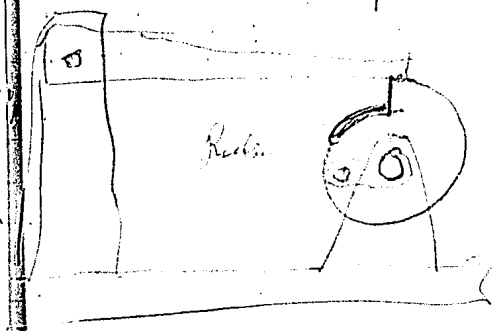
3 stage –

Receiving phone reg Bell. with metallic center holding a short 1/2 bore tube 4 used to put rubber tube on

Phone land flat on 2 Rubber sponges on top of a flared horn tripod of metal –

This is from room floor air or other sound when Helz plugged at phone even when using Receiver

We have fixed up the old wood Rubber wheels which I once used for making noise



2 of these used 1 in the Theatre room drops only 3/4" on Rubber with both doors closed. Keeper hears it OK 60 Rev Min —

When many gals of water drop from this box 5" into a wood box the bottom of which is thin acts as a sounding board

[Edison hears sound within a fort]
Hayes notwithstanding this
noise can hear Cam deer
in Meadows room —
Edison hears in Audion
the water moves very
strong being about same
as Boat under test conditions

WE have another Cam
noise maker which has
heavier lever falls a
greater distance & make
a great noise this is to
represent Screw noises
of Cargo boat,

We have on shaft a
wheel, on the surface
is a copper piece 1/9 of the
whole area. This piece
connected to a continuous
collector ring with
spring — There is
a spring running over
face of wheel —
Now when lever drops
at the moment the noise
is created, the circuit
is closed + then switches
the listening phone
so second is not heard
The spring must lag

$\frac{1}{45}$th of a second to allow
for loss of time of wave
travelling 25 ft from
room to Back phone.

Just tried a preliminary experiment
It is very ok but length of
sound is a little too
great for length of copper
on surface of wheel -
The trouble is that
whole expression comes
after blow.
after lengthening contact
we dont get it perfect.

Sounds like this III—IIIIII

III—IIIIII. No matter how we

adjust, We get phone up

close and get III only

We now think that we

balance or short out the

main sound + that

the Extra sound III—IIIIII x

x is the echo -

We now run wires out

100 ft about to center phone

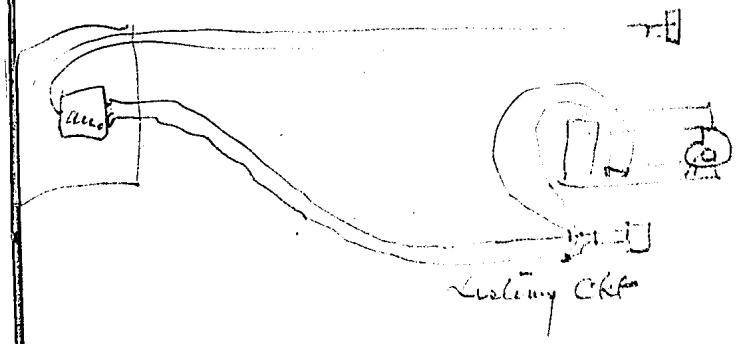
at garden behind garage,

thus

New idea.

The intermittent sounds from steamer is composed of a few non periodic waves around 1500 to 400 sec-
The group time according to phone is $\frac{1}{400}$th of a second
Standing flow wasted + no wave periodic the car is not resonant to the undamped waves + the whole is weak
If need we use a small chamber connected to the ear. The group will enter + reverberate by echoes + be periodic ~~so~~ (ie) the group

next page



This will practically cut out room echo.

is periodic + not like water

20 ft away Piano is turning
the Cam machine I cannot
hear it if I put my hand up
to extend my ear I cannot
hear it but if I form
my hand to form a small
chamber with 3/8 hole for
sound to enter I hear it
very loud, if I close
the 3/8 hole by a finger
from other hand I hear
nothing. closing chamber
removes the sound by
echoing or reverberating + gives
ear time

July 15 1918

We now have water spray
near Center of Garden
2 ft from phone mouth,

~~[illegible]~~

~~[illegible]~~ Piano not working

Cant
Hear (left drop. Sub)
hear 30 ft 9" away

~~[illegible]~~

~~[illegible]~~

We now have water drop
set 3 ft away from
phone - this is a little

More than 1/2 the strength of noise from the regular dropping going to phone —

Can hear sub drop lever at 25 ft - Burns not working

Water 3 ft Burns — ft

Sub limit still 25 ft

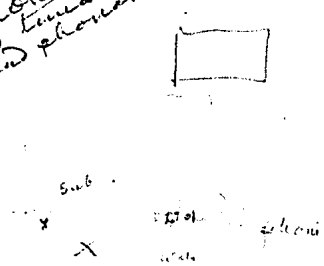
Burns lever doesn't latter. 70 times

Now phone 4 ft away from water -

Sub lever heard to 28 ft. 30, on box - something wrong

Bad arrangement we now change it out doors

Listening with
Stethoscope which
worked in 2 or 3 times
worker then had phones



Sub, water Burns & mouth of
phone all point south to where
get no audio from walls of
garage

Water 4 ft from phone
Burns 8 ft
Sub - 28 — 40 to 1.
Hear, sub on box to 30,

Sub 35 ft, Hear to 28 on
box — 76 to 1

Note that on account of auto action of Ear-whole a noise of 100 + one of 5 cant be heard a noise of 50 + 2½ is heard Ear + 1 of 20 + 1 is far Ear to hear 1 with 20 noise than 5 with 100 noise -

We not put Sub at 40 ft. Hear to 22 on box - 100 to 1

We now put Sub 50 ft away Everything else the same Here on box to 16. 156 to 1

We now put Sub at 75 ft. Hear to 2 351 to 1

No noise except air

We now stop Burns + also the water + see how far we can go with only normal sounds received from the air. at 75 ft hear to 34. 351 to 1

Sub 100 ft away hear on box to 20 625 to 1

150 ft. hear on box to — 12 1400 to 1

Sub now 200 ft away
Hear on box to Nothing

We go back to 175 ft.
Hear on box to -4- 1915 to 1

2.3 times further
than if Burns were making
boat noise & motor
noise was 10 kq-

Sub 165 ft & Burns only
working boat noise Engine.
nearly compensated but not
perfect on account unlevelly
turning & jump of contact
points, No water noises
Hear to Zero on box -

Scheme

Put tubes down along bow
wards & collect ends at
leaving end & use a regulator
this would make so much
noise all will be heard except

The present opts in continuous
water noises is due to 2 or more
gates combining to increase
amplitude, if 6 or 8 replace
& a reverberator is used. Hydro.
sound can be made continuous
& dimmed to almost
nothing –

165 ft for sub – water off
Burns off – only normal air sounds
Hayes turns! sub at same
speed as usual – then
1/2 this speed then twice
this speed – want to
ascertain if very fast is
more audible than slow –
Hear to come for all
speeds of turning. Hydro
says speed makes no difference

Put sub at 50 ft, water drag
+ Burns boat turning –
Hayes sub turns very then
faster + then slower
Slow + Reg speed hear to 10.
the fast one to 14 on box

We now ~~feat~~ on Boat sound
will shut the Control of engine
& make Coffee Control Even
with face of wheel so there will
be no jump to see if we can
get rid of the slight click sound
that comes at times —

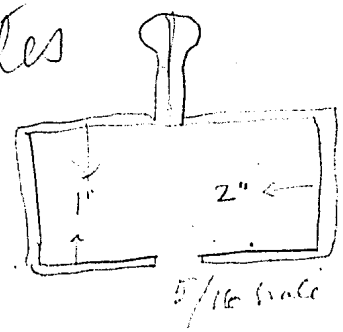
When Burns boat shuts
steel & shut off on of
he deaps. Lever by hand
can hear it very weak
this is either due to Echo
from Quarter or too
much resistance in shunt
Its probably the echo
Edison Cant hear it at all

This shows we certainly
can cut out Engine noise on
boat with 1/9 turns short circuit

Burns turns at 6 Rev men
with short ckt on cut cover
Throw back -
Hayes 165 ft is turning
sub — Then to find effect
if Burns short ckt of sub
can be heard or interfere

Can hear Known short ckt
clear but all noises from
over is cut, But this does
not interference with
the Sub

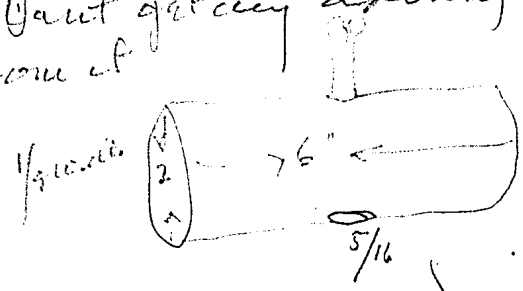
Notes



1/8" walls

Brass

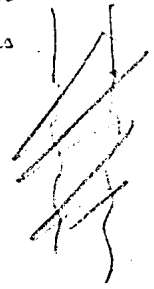
With this - I can hear several times strong a noise third like Burn Machine -
When I cant hear without it I can go twice the distance away & hear it loud -
YET Knowing Harley
Cant getting advantage from it



This mg. Kills Thud sound

Now Knowing with Burn machine turns as fast as he Can - While Harley turns Dub at Regulated to use of shortstroke more affect on Dub -
On account of Knowing Machine being as close to plane & sounds he generates in fast Turning cant hear Dub -

We succeeded second from
Brown Boat Cam Machine
with plane 100 Rev wax
Cylinder — area of objective
100/1000 — of one knock
duration of one knock
120/1000, 1/75 of a second
is duration or cylinder
would hold vibs of 75 vibs in
1.4 turns



11 To 16 Waves
Waves at rate of 1050
per second —
A The bunch of waves
Each bunch almost

a duplicate of the others
1 jump out in each —
2/3rd tracking width —

Every wave appears different
2/3 one twice as long as width
of tracking — 1/3 shorter —

Water shower dropping
on center of 2" dia
1/2 width tracking
~~Well~~ Many jump outs
Study it more

Now a single drop 6 ft
on 2" Dia Same as
in the room Echoes
Dont record There are

8 Vibs, Euchrone Longer ~~the~~ less amplitude - first to buy with tendency to jump out -

Vibs covers 1/3 the area 50/1000 - over 2500 per second.

Experiment with microphone + Bell phone comparing using a watch -

Water diaphram on Metaro 17 hole Mica — thick -

1 cell battery all out

Center of garden — Water from two box dropping 6 ft in a box same as use been using

Micro very loud on Zero
much louder than Bell -
but both go to 50 on box
so no gain by Micro
but a bad characteristic
when working near
Zero on box where we
want to work

We put on 2 cells on
Micro - 54 on box
dont seem increased by 2 cells
Bell gives 50 @ 54 -

The Micro has 2 diaphrms
its scour at end of channel
another Water dia Mica

Neuscheme

We Check phone men by
Water, run it so close
that all strong ribs are
supposed by black mat
running fast enough
Chalk running just
fast enough to Hecky
doubler work weaker

backed up by 17 holes.
Moore takes the 17 hole
diaphin so micro has
same chance & condition
that Bell phone has —
Micro now 60 on 60 on
boxes I call —
We take it further away
from drop water board
leaving Bell in same
place (16) 4 ft —
We now place Micro 8 ft
from Water drop — this
makes it 4 times weaker

Can hear it past 60 on boxes

We now shut water off to see what other sounds from the air, as it may be these sounds we hear - its very quiet at OK

We now go off the the Sub twining Pump 300 ft this represents a difference 4 times greater than the Bill which went to 175 ft all original noises clapped

Cant hear — too much
air noise —
We now go to 250 ft.
Cant hear —
perhaps Micro adjusted
too sensitive — our noise
make it fry
Nothing certain so far
in Micro Experiments recorded
to this point —
Adjusted Micro less sensitive
fairly quiet now — Cant
hear Sled at 250 —
at 100 ft. Can hear it
but Hanley hears it
direct with Ear in

take 14 ft ½ lubang go down to center of garden & see how far can hear Sub.?

Also – put in telecom Mics & input coil of Audion on induction coil with ½ or 1 ohm primary + 1 cell with 5 ohm wound of Rec. Then will give say 200 milliamp fixed contact steel with 20 ohm.

garage, Something is radically wrong with the adjustment of the Mics – or the Audion or Elsewhere.

I think trouble is that induction Res of primary of Audion Input Coil is very high – where the EMF from 1 cell + ~~too~~ vibration is too weak We should insert a Burnel Coil with 1 or ½ ohm primary multiplied with Audion input & add 4 ohm or more to prevent frey of Mics.

I put in 1 ohm Coil + 580 ohm Bunnell – the ~~[illegible]~~ Secondary of which is connected to primary of audion – also 5 ohm in, Edison heard on 2 of boxes. Where I can't hear anything from Bell phone on Audion – Harper talked out of range would on 75 ft from phone in Center of garden ~~[illegible]~~ It was louder to Edison when Bunnell Cut out + connected long wire to audion with from 5 to 100 ohm in series –

Edison Heard Well
5 or 100 ohm Res

Making little change in loudness but 200 Ohms Cut it considerable —
The whole trouble is Continuity which but better Edison Mask but is failed to normal Ear as its no louder than Bell to them —
Microphone should be of such a nature that on a 3 stage Circuit it should not give a fry but may give a perfect continuous weak noise like listening to the Ocean at a distance in a Conch Shell —

July 16 1918

Experiments with phones in open air no echoes –

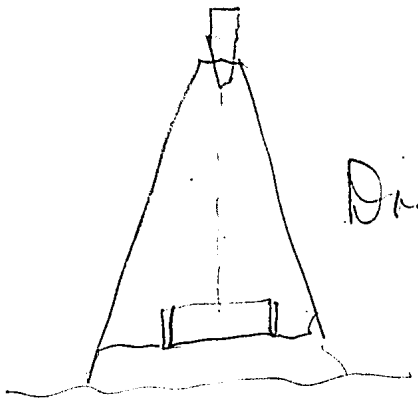
Receivers at center of garage garden –

6 ft water single drapper used on 2 leg bridle can of water. Thus to be moved along path gradually receding from receiving apparatus, to determine relative sensitiveness of dif receiving apparatus
Bell Magneto Bell Mono +
56 ft of 1/2" bare brass tubing
+ direct listening with stethoscope

All of course gets the normal air noise –

Use test Bell Magneto
Receiver in center of garden connecting to 3 stage
up in garage

* Moore in ~~top~~ Carriage hears it with Ear alone 50 ft quick dropping Moore hear to 75 ft -



Dropper

Moore hears by Ear at 100 ft,
" " 125
" " 175 -

Moore tested the whole range of Reverberation
Can get only now & then at 100 the drop
Natural Ear better, But he says it
amplifies other noises & gives a roar
he dont hear natural Chain -
Smallest "beat all around

Bell at Center of Gravelow

Water drops 50 ft away from Phone
hears when continuous stream
to 14 on Box -

* We now quick drop. at 50 ft.
We get it at 44 on Box (limit)

We now remove water dropper
to 75 ft from Phone
Hanley goes to 32 on Box

We now remove to 100 ft.
Hanley hears to 12 on Box

Now put Water dropper to 125
Hears on 4 on Box in quiet
periods.
with normal or noise
LIMIT

175 ft with plain Ear to Moore near limit of hearing. but he think he could hear further

Moore at 200 ft at time gets it with Ear only

We now substitute the Bell Microphone
1 Cell battery goes to 54 on 6 box =

Now put dropper at 175 ft.
Hanley goes to 18 on box but only get it once in a while —
Would be better —
This is practically twice as sensitive as Bell Microphone — under listening in condition

We now keep it at 175 ft and add another Cell of battery making 2 cells on phone
Hanley goes to 30 on box

We now move dropper to 200 ft. once in a while get it at 10 on box

2.56 times more sensitive than Bell Microphone notwithstanding increased noise

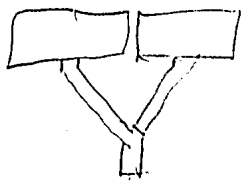
* of course outside noise
masses with additional
battery battering listener.

We now put on 3 cells
* Dropper being 200 ft —
Bell Mears — goes to 14
on box — This is slight
but a gain as with 2 cells
only heard occasionally
whereas with 3 cells heard
it at all times —

We now put 2 Bell Mears
in Multiple arc & use
2 cells — Dropper at
200 ft — Can hear to 12
on box but telemophone is
noisy
The 2 phones at sct in
line facing the Dropper.

We now put the 2 micros in series - 2 cccs Drapper 200 ft - Hear to 14 same as other but its a little more ultrasonic noise -

Each micro so far has its own hole we connect both together by a Y



Phonon Multiple

One aperture,

go to to 18 on Cox-Hanley says clearer

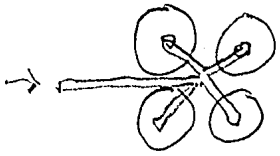
Note

Think 2 phones in multiple halves the roar by doubling the freq vibs thus diminishing amplitude = + a better proportion for ears than 1 phone, the increased quietness also raises sensibility from 10 to 18 on Box - or over 64% increase in sensibility in all three Experiments allowance must be made for constantly varying air noises when wind which greatly interfere with Box test figures -

Think 4 Micro in multiple with 2 cells would eliminate granule movement noises + still be as sensitive of ideal more so than 1 micro, lengths from mouth of input tube & same for all

We took one phone off + disconnected it to see value with present air noises - not using Y plain phone as in first Experiments - Hear to 10 on Box seems to be more roar in with 2 + Y Evidently 2 in multiple + Y is best,

We now put in Moores mico with 1 cell - in place bell micro - Dropper still 200 ft away - Hear to 24 on Box but when it starts to fry only to 10 - Moore had increased weight on lever it fried too much + was so sensitive lost 20 something



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Moore now is increasing weight on bag still further as its flying again—

Dropped still 200 ft—

Cant be sure heights it — seems as if adding weight it makes it very much more sensitive to outside noises + this prevents us hearing drops.

There is a defect in Moores phone.

He has a very flexible tube at X connecting phone box with outer brass tube

He now will now take off Rubber tube + solder it —

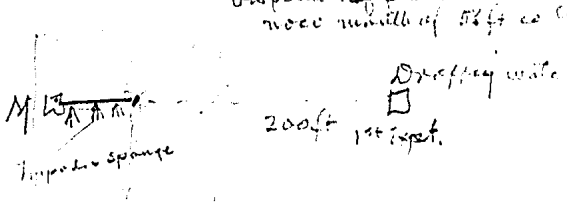
We put back 2 Bell Mers

that 200 ft. heard to 14 oz box
showing conditions not
changed – that I can hear
Moore Heard, with the
~~added wt~~ the extra weight
he has added after the
experiment where he got
24 oz box at 200 ft
Evidently the extra wt
has stopped gun more
but made it less
sensitive,

Bell Magneto & Audion are selective to certain sound differently from Moores Micro & Audion - & Bell different without Audion but Moore Stethoscope —

We now put 56 ft of ½" brass tubing consisting of 3 tubes 14 ft long 1 tube 10 ft long & 1 14 ft long - ~~two~~ 1/32 walls to tubing —

We connected them all together in a straight line by short rubber tubes —



We first listen at M with Stethescope then connect 2 Bell Moores to end of tube by a Y phones in multiple & 2 cells — for Audion

With the 56 ft of tubing
Cant hear the Dropper 200
ft from the Mouth looking down
says its very quiet —
probably friction too much

We now connect the 2
Bell Micros Y connected a-
in Multiple one with 2
Cells of Battery to the 56 ft
Hanley hears to 14 on Box
but not so loud on Zero
of Box — says at Zero
the noise is very much
less than any other
arrangement we have had
says dont hear dropping
steady but comes + goes
says it may be the wind
perhaps drops deflected
by the wind

New Experiment -

Tried some Experiments with Reverberations

Edison with 1" Reverb heard drop 6 ft. by ear 10" by 1 inch - Reverb 36 inches -

~~[illegible]~~ : 63 ft average [illegible]

The 6 ft heard drop by Ear - Hanley heard 14 ft. further, the others 9 & 8 ft -

There is a vast discrepancy between Edison and others with Normal Ear with its Very Sensitive accommodation approaches like the Eye

The ear outside senses & a roar which dampens their

diaphrms so much that it
nearly equals the increase
of Valpuki brought out
by the Reverberator.
Edison if square law is OK
gets drop 12.9 times louder
in 1" Reverb. Whereas
Stanley only gets it 1.5
times louder or 58%

We are now connecting 4 Bell
Micros together for test, 4 way
Connector 1 mouth - 2 cells
audion Water drop rapid
200 ft away.
Its not that I Expect they
will be louder but that

Note

When dropping water on to water in 6 ft in which phone is immersed 24" from surface drop & when faint, sometimes big bubbles are formed when these burst the sound is very loud —

When falling from many holes 6 ft onto wood bottom of a box & all drops seperate there is no spitting sound Edison can't hear but when many drops coalesce & form a gob Edison hear them as spitting in receiver just like I hear on boat

The internal noises due to jars & intermovements of the granules will now be 4 times as many & then cancel each other out. If there is a fry in one phone it will short circuit in the phones that do not fry
In other words it is to stop noises from the phone itself which has the effect of making it more sensitive by preventing "Acoom" in ear to them —

We get 16 on the box
Dropper 200 ft - 2 Cells, no frying or internal noises in phone themselves are heard
We now plug the free end to see if there really is any granule noise or frying

If the bow waves fall over a spray or all drops or white then the sound microphone will be weak but if in addition chunks of water fall each will make an water loud sound + will be cause of spitty surface, discontinuous shower line

drops shower

Spitty

x added on shower

After plugging there is a perfectly clear room quite weak no fry — Can hear it on box to 12 Of course ear is in this condition marvelously sensitive, All garden Experiments with stethoscope + long phone amplifiers very interesting

We now remove long phone receiver + stethoscope tubes + connect Head phones to see how much better they are as they can be used in Cow hair Goath —

All experiments since moving into garden, Stethoscope listening tubes used up to 10 pm — + we find it very poor

With headphones Hear Dropper
to 56 on box - with ~~[illegible]~~
~~[illegible]~~ 4 Bell Mics
Connected to 1 tube,
Audion + 2 cells -
On Sponges as acc action
Experimenter. The noise
is very great on Zero + it's
a wonder Hanley gets
Dropper at all Edison
hears to 15 on box
We then plugged the end
of the tube leading to the
4 Mics but the noise
is just as bad - Edison
thinks sounds from air

like Locomotive jars the
phones as they are on
sponges + there affects
every movement to phones
+ this jars granules —
Edison heavy ~~st~~ train start
+ accelerate on 6 of box
+ its very clear so clear +
sharp that he didn't notice
much the other noises —
Evidently phones must be
rigidly fastened to block of
1 or 200 lbs set up on
sponges so it can't oscillate
Edison also found 1 head
phone so he could hardly hear
in it while the other was
* Very loud 3 or 4 times

Also tonight when Bell was
receiving in garden + Sleitscape

* since found Dolphin bracket
+ touched Magnet

used we got continuous musical sound like an alternating Ckt 6 to 8 on box for Edison, Hanley all thru bldg + yet when we switched over to the 4 micro + used head piece couldn't hear

We had 4 micro on heavy plate + this on opposite sounds Edison 6 to 8 on box — ditto, phones hung from rubber tubes from board 2 ft long E hears to 16 — Held it in hand E hears to 4 — This is best. all these inputs we had input lines to the 4 phones Plugged

yet plugged or not sound
was about same —
When plugged talking
at phone was loud to
Edison then Condon ??
Its the enormous def in Laurence
between Olethorpe that
brought this Bad defect
out —
Tomorrow we tackle
it —

Micros with granules seems to be about worst form for Boats that Roll & Pitch

Some form must be devised that will not move ~~to much~~ by pitching -

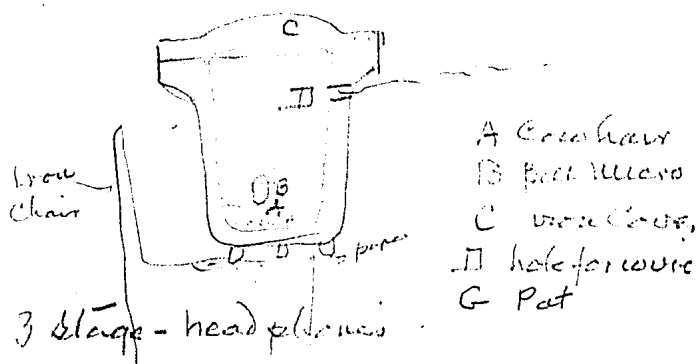
July 17 1918

Experiments to prevent plugged Microfones from being affected by tremors from disturbing it when 3 stage audion is used & most sensitive head phones used

Edison hears noises when mouth of Bell Micro is plugged, which is lost at times at 16 on box & other times 6 on box -

Want to get steady noise down so Edison can hear on box

Hydrogen Annunciating Pot, 6 Bat cells



Wires at D wedged tight to wires by undulations coming wires from mouth phones, 1 One cell.

The noise is awful, slight scratch on Pot keeps heard it many ft away I hear it strong in phone

Talking near it very loud to Edison in phone, although an orifice of phone is closed or its inside closed pot

Edison Coils

Noise goes to 12 for E-
Burns walking sometimes hear
to 8 - but its very clear & dull
good sound. no sharp or spit sounds

Hanley blows puffs of wind Edison
Can not hear at zero,

laying Cord on floor makes
no difference -

Passing fingers over wire cord
very very slight -

When Edison gets 12 Hanley
hits Pot when phone slaps
noise, WE turn it up-over
but its use it wont quiet any
noise Hanley says very
slight but it is now rather

insensitive Edison cannot hear now & then when Bucks Sarah's pat,

We now take Cork out of plugged and no change Something must have gone wrong with Audion as substituting a Bell Magneto & talking right into it Edison hears nothing whereas the sound should have been heard a 100 ft with 3 stage

Bad Contact in a wire tests with Bell Magneto show all right now

* Due to listening phone reciprocally

We put Rec Micro back & in Pat,

* High rate every 4 sec, lots other noise, 1-

With phone plugged hear talking plain — walking on cement floor strong noise faintly — the conversation noise moderate.

Even when E. leaps on his walking table lightly he hears it from far of table from cement floor to pat ultimate to plugged Micro

We now put pat on a board & between board & chair put a sponge

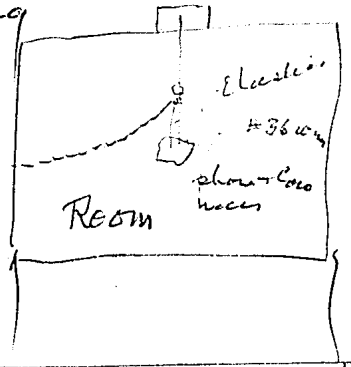
Pat (road) - phone plugged
near Sub station at head
of our way - not only is
jar waves transmitted to
phone but air waves
through wire pat affects
phone even more strongly
the stronger the sound
the stronger we get it,

Mics cant be protected
from air or jar sound by
shielding with Massive
metal [probably the air waves
get thru the hole for wire and]

We now wrap Micro with $1\frac{1}{2}$" Cord hair - PLUG hole + use #36 wire to conduct the ends of which are connected to reg Cord -

The Cord is attached to the pulley + block rope we used for water dripping pail -

The phone ilwdg is suspended from pulley block by 2 rubber Elastics 1/16 sq inch out + 2 ft long



No Cow horn on in this Experiment.
This is an enormous improvement
have high sympathic musical note
comes once in 3 or 4 sec
Tapping table hard breaks it
for a moment on 10 of
Box This note is not but
faintly heard by Edison &
Dont bother — but the
slightest tap by finger nail
on Edison table is very loud
on 10 of Box. Talking &
everything clear,
Great improvement.

OK – There was constantly
Coming now & then high musical
Swiges, it was certainly reciprocation
between the mics & listening
phone then air as I moved
it away 25 ft into Theodora room
and I never got it. Think all
whistling of condition is between
itself & a source of sound which
gives a lag – or 2 sources of sound
one lagging the other when
these are separated. Condition
even 5 stage will not
whistle.
I heard Hayes 25 on 60X
when he was turning Bigger
Sub in lower garage
but neither I or Hanley could hear
it when he was at foot of 1/20 House
stairs too many other sounds

All this may be useless
will know further along

men were also sawing &
splitting wood 275 ft away
& then all other sounds
in neighborhood –

It looks so far that the
smaller the micro the better
Think it can be got in 1/2
Cant say if it should be
light or heavy. it probably cuts
out all waves above 3200 ~~[illegible]~~
~~or~~ not affected by large waves creating
no appreciable pressure shadow

We now take 3/4" micro port
out at Center of Garden
& suspend it & see if it
gets less noisy, also see
how far can get submarine

The small button appears to be not very sensitive Hardly Can hear to 125 ft which is limit of Bell Magneto

Now is small 4 wires it call for Edison — E hears Sub at 50 ft — on Zero box

We now screw the tin diaphragm on button screwed to the mica

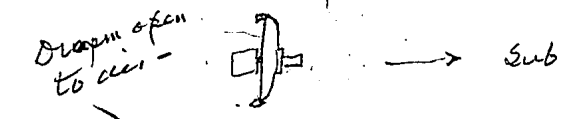
to see if sound ~~shaking~~ makes or what it will do

all suspended as now

Wind, even very gentle moves it & noise in phone band & broken NG –

We now suspend it with two elastics to prevent swinging by wind –– no better

We now suspend a Reg Bell Micro with front Chamber removed to get rid of Chamber Sound – Dia now expanded whole face & connected to Reg back



Suspended by rubber #56 cover for Connection. Same Chamber Cover it to stop wind

think from this a 4 stage
of Extra stage amplifier
5 times that it would
bring Bell Magnetos as sensitive
as this Mecro, + not have
so much noise

Remember 125 ft limit of Bell
Magnetos was obtained by very
weak stethoscope Magnetos + not
present head piece,

Hanley at 200 ft gets sub To
60 on Box – Approx 125 sqn 201
156 Magnetos 200, Mecro

The noise for Edwin is Cut out
at 12 on Box – yet Hanley
hears sub at Mecro this 200 ft

We advance sub To 300 ft.
Hanley gets it sometimes
at 4 on Box – this is
therefore 5 times more
sensitive than Reg Bell
Magnetos but more uncertain
More cheese cloth gives Sub
at 300 ft 8 on Box but
not steady

Apparently small hole + chamber is less sensitive freq than when whole face of dia is exposed, found this true at Key West.

We now hang Bell Magnetic in garden by same stand of suspension as Micro with cheese cloth to test limit of sub with good head piece received against the 125 limit with Oklahoma + Poor Richard —

Hardly only just hear on 2 only occasionally at 150 ft

But when front chamber piece taken off + a ring substituted exposing active surface of Diaphm got it at 150 14 on box

The day being dark Calypso has lights on + I can just hear the AC music-note

Put in Micro with latest suspension, full size of duplex
Exposed Edison Keeps it
plain at price of all models of
8 + Can stick lower at
14 on 60x showing
Micro protected from
jam etc is far better than
Magneto with 3 stroke
PROVIDED it can do
as well on a rolling
pitching ship

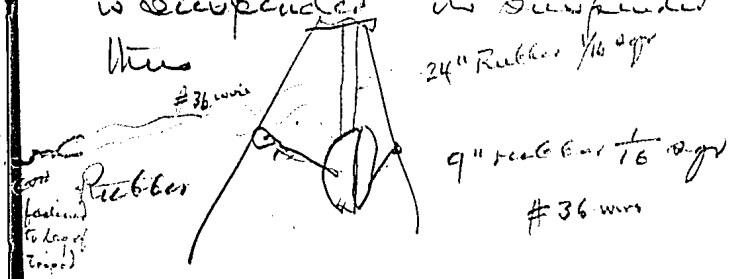
Tonight found it more noisy
than before supper probably
due to less sources, more
sources cancelling out

Hanley Cant hear Sub yet To 300 ft. One call on

Wrapped more cloth over Cheese Cloth – This is black front Cloth finer weave, after ~~that~~ the noise was launched Edwards on box

It started to rain or rather sprinkle can hear it it strikes leafs of Vegitables in Garden cloth not over bottom,

With above conditions we put sponges over legs of Tripod from which phone is suspended. Its suspended thus



Putting sponges under legs NG Edison gets noise at 16 –
awful on Zero – makes whole tripod with cloth around act like a sail & wind even the slightest must jar it & produce the Extra noise —

We remove sponges & Return to previous conditions —

We started the plane swinging its full inversion

about 6@8" & runs for
long time
at each turn it makes a
slight chuck but not
every time, This will be
very slow on a boat
& Hanley thinks it will
not bother at all
We took off the side ~~for~~
rubber guides to try the
pendulum as we are only
listening for support sounds
& not for submarine Bjon

We tried 125 ohm Rec. sounder Induction Coil in Receiving Circuit with idea it might by self inductance wipe out the fine Continuous sounds which sounds exactly like a Continuous soft surface on a device — But inductance not enough - Coil too quick Bunks gone for a large Input or Output induction Closed ring Coil -

We are going to use the ladder that we used for dropping water & get a longer suspension if possible get it twice as long say 4 ft present rubber is 1 ft long untreated & 2' 6" long + with weight phone on

With ladder untreated rubber 1/16 2" 6" & stretched 6 ft. 2 ft off ground

~~Noise~~ Noise worse than before Edison hears to 16 on box - This is no improvement of outside noise with the drum

We now started the expansion
rubber 6" unstrained 12"
checked

July 18 1918

Hanley listening in the
big phono funnel this
morning says considerable
more noise this morning than
last night at 10 p.m.—

1001

This morning we put Bell Micro in Big Iron Hydrogen atmosphere put, put lap on with gasket run wires thru side hole, plugged thes with wax so no air could get in —

The frying was so loud as Even, — One call on Burns talked 5 ft away heard nothing. Then he got within 12 inches talked loud, an intermittent metallic ring was all that could be heard

Proving Most of the noise 90% is constant internal dancing or movement of the

1° finer grain granules
2 Lampblack Coated granules
3 Magnetite granules
4 peroxide Lead granules
5 Sulfide Copper, or Calcopyrite granules
6 Lampblack mixed with tannic of Rose Vine with Extraporia & 6/4 mixed by using Mers alcohol - Dried then pressed in Hydraulic press & dried by heat. Then screened out to my phone wgh.

7 Ditto mixed 200 mesh Iron by hydrogen not self heated - + use magnet 6 & 4 phone

8 Magnesium also Aluminum granules

9 Mix of Bismuth & Antimony granules Equal numbers use no battery make thermo Current

10 - Nickel by H.

Next page

Carbon granules

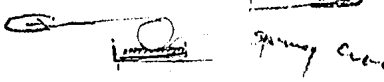
This is the line of Experiment we will take now

We now fill the cup commencing the Mers granules with of ordinary Kerosene Oil to see if Mers Breaking Mers granules wont Clap -

Edison cant hear on Zero of box we now take it out

11

Reg Coil on button. ~~[illegible]~~
between Audiphone & earphone
~~[illegible]~~ to spring tension



12 - Try finest Audiphone
balls instead Cotton

face if it will cut as in
Microphone in air.
Its OK Can hear
Submarine 300 ft
at 4 on the box - best yet
Micro being laid on
Sponges one coil on
Sponges - There is more noise
than in Pot presumably due to air pressure
We need hang it on
elastics & surround with
cloth to get less pounds
noise of pressure

Only 1 coil on these experiments
Suspending dont do any
good Sponges seem to be
best

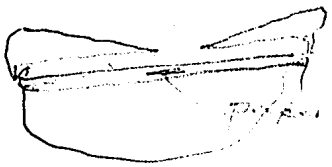
We can get it out of same co.
sponges but noise slightly stronger
to Edison

With 2 cells, noise is only
increased off a little
Hanley hears sub [illegible] away
to 9 on the box but if the
back of head phone is used
it suppresses all the noises
& he hears to 16 on the box

We could hear [illegible]

2 Cells The Milwaukees
flooring is 110 Milwaukees

Hanley puts a piece of paper
between ~~the [illegible]~~ two



diaphrms

on listening headphones
He hears to 30 on box
Sub 300 ft Micro on
sponges. Removing in
granules — [illegible]
We moved to 325 ft
get it to 4 on box
by Hankey

Tried on listening phone 014
020 025 — but none so
good as double diaphm
with paper